A new type of silicon probes with multi-site microelectrodes for single unit and local field potential (LFP) recordings from cerebellar cortex of anesthetized rats

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Tactile inputs to the Crus I/II of the cerebellar hemispheres of the rat display a fractured somatotopical organization. The functional significance of this is not known, but it is presumed to form the basis of the integration of information from different senses or parts of the body that are used to plan and coordinate movements. In order to study the processing within and the interaction between local circuits in different receptive fields it is required to simultaneously record the single unit activity and LFP of multiple nerve cells in different layers with high temporal and spatial resolution.

A new type of fork shaped silicon probes with multiple microelectrode sites was developed within the VSAMUEL project. The probes were micromachined from batch-fabricated silicon-on-insulator wafers. For recordings in the cerebellar cortex the probes had 32 Ir or Pt microelectrode sites (size 10 x 10 microns, input resistance 0.5-5 MOhm) distributed on 4 or 8 shafts with 4 degree taper, smooth side walls and sharp tips. Spacing of electrode sites was optimized for recordings cortical neurons in different layers. The probes were connected to a specialized preamplifier via a flexible printed circuit with 32-pin ZIF connector. Extracellular spike recordings and LFPs were separated using different filters and obtained simultaneously. Single unit recordings from Purkinje cells and other large interneurons (putative Golgi cells) were isolated at different points of the recording matrix and correlated with each other and with the LFP at different sites. This new recording technology was evaluated by studies of the flow of information within and between receptive fields during responses to tactile stimulation.

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